

Statistical voting analysis in the Michigan 2020 Presidential Election

Wayne and Oakland Counties

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A handwritten signature in black ink, appearing to read 'Eric Quinnell', written over a horizontal line.

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Executive Summary

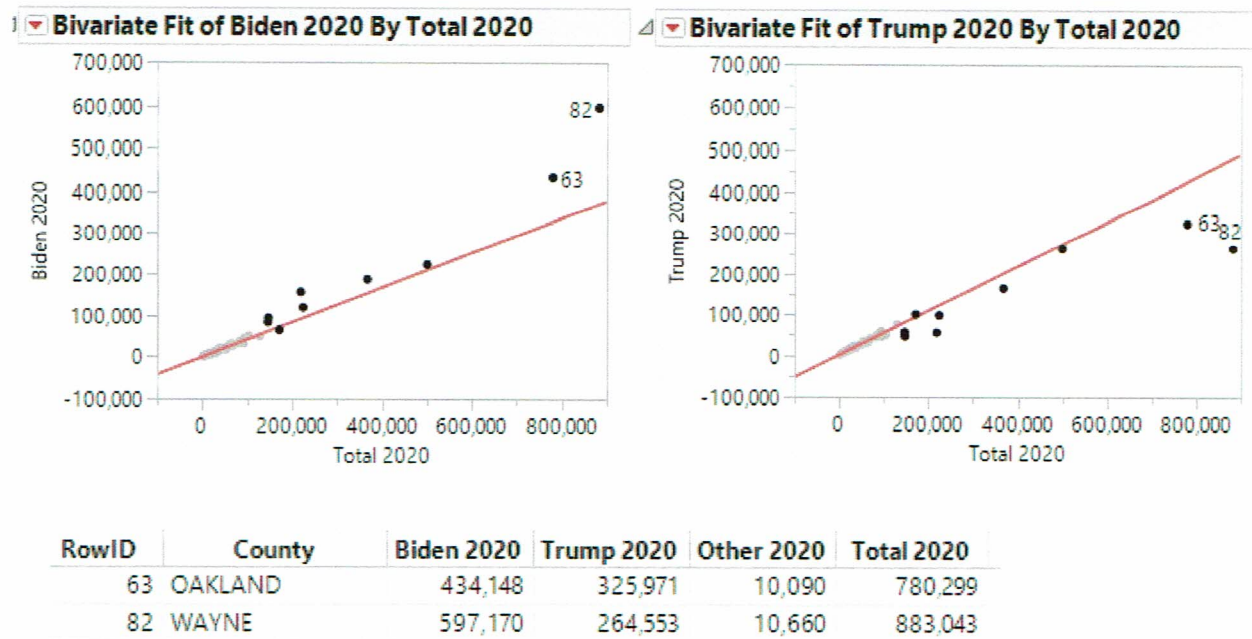
Analysis – A team of unpaid citizen volunteer mathematicians, scientists, and engineers collaborated in a statistical vote analysis in the Michigan 2020 Presidential Election.

Using simple linear regression of unproblematic voting districts, we predict hypothetically problematic voting districts. Using distributional characteristics within problematic counties, we point to problematic districts and precincts.

Findings – Two Michigan counties stand out as problematic in this analysis. Wayne and Oakland counties show approximately 40,000 and 46,000 excessive votes above a standard distribution, respectively. Problematic districts and precincts within these counties exhibit unusual Democrat to Republican ratios as compared to their history. Additionally, some precincts show an excessive number of votes in favor of candidate Joseph Biden sometimes even exceeding new voter registrations.

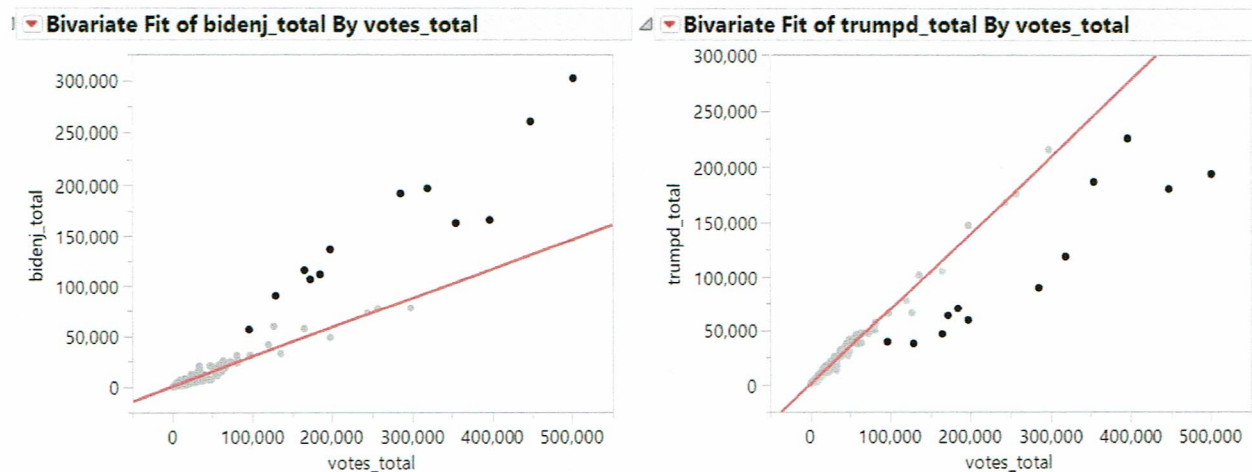
Wayne County/Oakland Counties Stand Out

A bi-variate trendline across all Michigan counties identify Wayne County and Oakland County as behaving well outside the voting trends of the rest of the state in 2020. Thus, these two counties were selected for deeper analysis.



Wayne County

A bi-variate linear fit of the Trump and Biden votes in 2020 Wayne County shows major precincts completely off the trend line as compared to the majority of the other precincts in the same county. The points exceedingly off the fit are mostly those in the Absentee Vote Counting Board (AVCB) districts. Several others outside of Detroit also miss the trend line of the rest of the area.



The AVCB mail-in districts within Detroit have no ability to correlate with the precincts inside the city, so a historical voting pattern per precinct is not possible. There is also no indication that the AVCB distributions include the same precincts from year to year, so therefore there is no way to link AVCB in obvious ways.

Instead, we first looked at the remainder of Wayne County. Outside the city, we have much more voting history and can observe both mail-in votes as well as election day votes correlated to a precinct..

Outside Detroit, Wayne County shows a significant disruption or new vote distribution well outside the 2016 norm. Specifically, both candidates achieved the total 2016 vote count and added to their sums, consistent with new turnout. What's curious is that above the 2016 totals, a new vote ratio appears in contrast to the voting history of the area – showing new votes going 70% Democrat vs 30% Republican – a 15-point mismatch to the same area just in the last Presidential Election.

Gained Votes over 2016 Avg per Precinct	
<i>Trump</i>	79.85
<i>Biden</i>	185.41
<i>Diff</i>	105.56
<i>2020 Dem/Rep Gain</i>	2.32
<i>Ratio</i>	
<i>%</i>	70D / 30R
<i>2016 Dem/Rep Historical</i>	1.29
<i>Ratio</i>	
<i>%</i>	55D / 45R

Voting totals of precincts may presume to follow a semi-normal distribution with enough data points. By fitting a normal distribution to actual data and taking the difference between the fitted and actual, potentially anomalous precincts can be identified. Using a per-precinct history, we can take an election result like this:

<i>2020 Actual</i>	Register	Voted	Biden	Trump	D/R
	900050	620483	356234	251664	1.42
<i>Turnout</i>	68.9%		57.4%	40.6%	

This results in this prediction:

<i>Total Predicted 2020</i>	Register	Voted	Biden	Trump	D/R	Excess Votes
	900050	580056	315807	251664	1.25	40771
<i>turnout</i>	64.4%		54.4%	43.4%		

This prediction helps us identify several townships outside Detroit in Wayne County that significantly stick out. A partial list of main townships that show excessive votes against a standard normal with reasonable variance:

Township	Excessive Votes
<i>Canton</i>	5735
<i>Livonia</i>	5428
<i>Redford</i>	4159
<i>Gr Pointe</i>	3052

Taylor	2891
Westland	2559
Plymouth	2400
Dearborn	2240
Northville	2111

As an example of the excess vote gains above the norm, consider the Township of Livonia, broken into precincts.

2016				2020 Gain									
Precinct	Trump	Clinton	Total	Dem/Rep	% Dem	New Trump	New Biden	New Total	New Registered	Gain	Dem/Rep	Dem % of New Registered	Dem % of New Votes
Livonia Pct 1A	650	783	1558	1.20	50%	119	263	310	272	2.21		97%	85%
Livonia Pct 1B	310	348	706	1.12	49%	51	106	137	94	2.08		113%	77%
Livonia Pct 2A	630	634	1337	1.01	47%	58	214	230	158	3.69		135%	93%
Livonia Pct 3A	467	492	1035	1.05	48%	64	125	132	105	1.95		119%	95%
Livonia Pct 3B	854	722	1680	0.85	43%	87	183	214	132	2.10		139%	86%
Livonia Pct 4A	1034	834	1961	0.81	43%	44	233	217	137	5.30		170%	107%
Livonia Pct 7A	823	638	1514	0.78	42%	31	164	168	102	5.29		161%	98%
Livonia Pct 8A	752	398	1212	0.53	33%	20	134	123	71	6.70		189%	109%
Livonia Pct 8B	598	426	1082	0.71	39%	18	135	114	30	7.50		450%	118%
Livonia Pct 9A	947	635	1651	0.67	38%	12	264	238	146	22.00		181%	111%
Livonia Pct 10A	615	478	1168	0.78	41%	47	153	152	105	3.26		146%	101%
Livonia Pct 11A	797	715	1625	0.90	44%	53	218	193	95	4.11		229%	113%
Livonia Pct 12A	544	671	1293	1.23	52%	78	159	183	146	2.04		109%	87%
Livonia Pct 13A	637	709	1426	1.11	50%	44	180	177	131	4.09		137%	102%
Livonia Pct 14A	755	721	1582	0.95	46%	53	163	143	60	3.08		272%	114%
Livonia Pct 15A	732	563	1361	0.77	41%	74	140	181	114	1.89		123%	77%
Livonia Pct 16A	713	506	1294	0.71	39%	84	133	176	106	1.58		125%	76%
Livonia Pct 16B	479	408	961	0.85	42%	46	85	83	44	1.85		193%	102%
Livonia Pct 17B	646	493	1219	0.76	40%	114	226	287	297	1.98		76%	79%
Livonia Pct 17A	732	488	1284	0.67	38%	-61	136	42	-111	-2.23		-123%	324%
Livonia Pct 18A	884	597	1552	0.68	38%	57	161	171	88	2.82		183%	94%
Livonia Pct 19A	674	494	1244	0.73	40%	57	148	158	103	2.60		144%	94%
Livonia Pct 19B	768	598	1472	0.78	41%	69	183	181	68	2.65		269%	101%
Livonia Pct 20A	861	602	1555	0.70	39%	32	208	183	90	6.50		231%	114%
Livonia Pct 21A	715	566	1369	0.79	41%	39	219	207	100	5.62		219%	106%
Livonia Pct 22A	712	576	1396	0.81	41%	33	223	192	119	6.76		187%	116%
Livonia Pct 22B	592	486	1142	0.82	43%	32	128	125	86	4.00		149%	102%
Livonia Pct 23B	508	325	876	0.64	37%	119	390	498	524	3.28		74%	78%
Livonia Pct 23A	579	550	1199	0.95	46%	-31	-89	-164	-315	2.87		28%	54%
Livonia Pct 24B	492	591	1149	1.20	51%	102	235	313	182	2.30		129%	75%
Livonia Pct 24A	535	610	1215	1.14	50%	69	126	155	161	1.83		78%	81%
Livonia Pct 25A	358	358	784	1.00	46%	24	122	105	107	5.08		114%	116%
Livonia Pct 31A	654	561	1286	0.86	44%	69	197	224	152	2.86		130%	88%
Livonia Pct 31B	600	520	1199	0.87	43%	45	193	190	172	4.29		112%	102%
Livonia Pct 32A	739	537	1345	0.73	40%	73	148	178	115	2.03		129%	83%
Livonia Pct 33A	850	680	1616	0.80	42%	86	225	257	136	2.62		165%	88%
Livonia Pct 34A	683	746	1532	1.09	49%	83	257	280	158	3.10		163%	92%
Livonia Pct 34B	651	591	1345	0.91	44%	48	215	197	126	4.48		171%	109%
Livonia Pct 34C	539	487	1107	0.90	44%	25	187	154	119	7.48		157%	121%
Livonia Pct 35A	517	468	1085	0.91	43%	67	130	121	65	1.94		200%	107%
Livonia Pct 35B	350	343	753	0.98	46%	28	144	135	62	5.14		232%	107%
Livonia Pct 35C	330	315	703	0.95	45%	45	121	121	70	2.69		173%	100%
Livonia Pct 36A	407	462	944	1.14	49%	62	145	163	151	2.34		96%	89%
Livonia Pct 36B	534	469	1079	0.88	43%	104	165	219	142	1.59		116%	75%
Precinct	Trump	Clinton	Total	Dem/Rep	% Dem	New Trump	New Biden	New Total	New Registered	Gain	Dem/Rep	Dem % of New Registered	Dem % of New Votes
TOTAL	28247	24194	55896	0.86	43%	2373	7595	7863	5015	3.20		151%	97%
				2016						2020 Gain			
				Dem/Rep						Dem/Rep		76D / 24 R	
				46D / 54R									

Nearly every single precinct first achieves the entire 2016 vote total for each party, but then a new population of votes skews excessively in favor of candidate Biden—resulting in a “new vote population” that is voting 76 D / 24 R...in a 2016 Republican township. Additionally, the votes gained by Biden well outpace even the new registrations in the township – gaining 151% of the new registered voters and 97% of the new votes above 2016. This result/example is incredibly mathematically anomalous.

Oakland County

Oakland shares the Wayne County mathematical curiosity well outside the norm. In Oakland, all votes added by both candidates above the 2016 take show a new vote ratio of 70% Democrat to 30% Republican – a 15-point mismatch to the same area just in the last Presidential Election

Gained Votes over 2016 Avg per Precinct	
<i>Trump</i>	70.79
<i>Biden</i>	179.83
<i>Diff</i>	109.04
<i>2020 Dem/Rep Gain Ratio</i>	2.54
<i>%</i>	72D / 28R
<i>2016 Dem/Rep Historical Ratio</i>	1.19
<i>%</i>	54D / 46R

As mentioned, voting totals of precincts may presume to follow a normal distribution. By fitting a normal distribution to actual data and taking the difference between the fitted and actual, potentially anomalous precincts can be identified. Using a per-precinct history, we can take an election result like this:

<i>2020 Actual</i>	Register	Voted	Biden	Trump	D/R
	1035172	771991	434148	325971	1.33
<i>Turnout</i>	75%		56%	42%	

This results in this prediction:

<i>Total Predicted 2020</i>	Register	Voted	Biden	Trump	D/R	Excess Votes
	1035172	750646	388023	325971	1.19	46125
<i>turnout</i>	73%		52%	43%		

This prediction helps us identify several townships outside Detroit in Wayne County that significantly stick out. A partial list of main townships that show excessive votes against a standard normal with reasonable variance:

***Township* Excess Votes**

<i>Troy</i>	4781
<i>Royal Oak</i>	4152
<i>Novi</i>	3911
<i>Farmington Hills</i>	3598
<i>Rochester Hills</i>	3597
<i>Bloomfield</i>	2696

As an example of the excess vote gains above the norm, consider the Township of Troy, broken into precincts. Nearly every single precinct first achieves the entire 2016 vote total for each party, but then a new population of votes skews excessively in favor candidate Biden – resulting in a “new vote population” that is voting 80 D / 20 R...in a 2016 almost even split Dem/Rep township. Additionally, the votes gained by Biden well outpace even the new registrations in the township – gaining 109% of the new registered voters and 98% of the new votes above 2016. Yet another example that is incredibly mathematically anomalous.

2016					2020 Gain							
Precinct	Trump	Clinton	Total	Dem/Rep	% Dem	Trump	Biden	Total	New Registered	Gain Dem/Rep	Dem % of New Registered	Dem % of New Votes
Troy, Precinct 1	462	434	944	0.94	46%	40	226	230	199	5.65	114%	98%
Troy, Precinct 2	805	792	1680	0.98	47%	53	231	217	189	4.36	122%	106%
Troy, Precinct 3	791	572	1446	0.72	40%	137	270	343	337	1.97	80%	79%
Troy, Precinct 4	974	998	2064	1.02	48%	48	350	341	273	7.29	128%	103%
Troy, Precinct 5	683	453	1193	0.66	38%	18	120	104	72	6.67	167%	115%
Troy, Precinct 6	204	177	402	0.87	44%	19	55	61	40	2.89	138%	90%
Troy, Precinct 7	571	625	1251	1.09	50%	49	197	201	184	4.02	107%	98%
Troy, Precinct 8	536	731	1337	1.36	55%	29	153	125	68	5.28	225%	122%
Troy, Precinct 9	843	746	1683	0.88	44%	134	188	254	216	1.40	87%	74%
Troy, Precinct 10	760	673	1518	0.89	44%	21	306	263	273	14.57	112%	116%
Troy, Precinct 11	754	680	1496	0.90	45%	-12	183	123	87	-15.25	210%	149%
Troy, Precinct 12	523	534	1103	1.02	48%	56	128	155	137	2.29	93%	83%
Troy, Precinct 13	939	1037	2112	1.10	49%	37	312	251	217	8.43	144%	124%
Troy, Precinct 14	763	679	1508	0.89	45%	50	244	249	270	4.88	90%	98%
Troy, Precinct 15	695	687	1443	0.99	48%	2	288	254	200	144.00	144%	113%
Troy, Precinct 16	549	599	1223	1.09	49%	60	197	205	224	3.28	88%	96%
Troy, Precinct 17	746	830	1644	1.11	50%	-35	219	133	139	-6.26	158%	165%
Troy, Precinct 18	618	529	1208	0.86	44%	-14	177	127	111	-12.64	159%	139%
Troy, Precinct 19	595	531	1189	0.89	45%	-32	224	157	73	-7.00	307%	143%
Troy, Precinct 20	812	766	1647	0.94	47%	24	267	246	198	11.13	135%	109%
Troy, Precinct 21	486	536	1096	1.10	49%	67	194	214	213	2.90	91%	91%
Troy, Precinct 22	838	1008	1941	1.20	52%	82	320	329	325	3.90	98%	97%
Troy, Precinct 23	866	954	1908	1.10	50%	124	344	403	380	2.77	91%	85%
Troy, Precinct 24	801	669	1554	0.84	43%	181	178	311	295	0.98	60%	57%
Troy, Precinct 25	724	802	1604	1.11	50%	153	216	329	363	1.41	60%	66%
Troy, Precinct 26	616	699	1421	1.13	49%	120	332	369	330	2.77	101%	90%
Troy, Precinct 27	404	671	1131	1.66	59%	128	150	246	280	1.17	54%	61%
Troy, Precinct 28	380	679	1109	1.79	61%	60	155	173	149	2.58	104%	90%
Troy, Precinct 29	840	885	1848	1.05	48%	35	236	179	168	6.74	140%	132%
Troy, Precinct 30	202	199	425	0.99	47%	-12	81	56	27	-6.75	300%	145%
Troy, Precinct 31	319	238	590	0.75	40%	24	136	141	95	5.67	143%	96%
Precinct	Trump	Clinton	Total	Dem/Rep	% Dem	Trump	Biden	Total	New Registered	Gain Dem/Rep	Dem % of New Registered	Dem % of New Votes
TOTAL	20099	20413	42718	1.02	48%	1646	6677	6789	6132	4.06	109%	98%
				2016 Troy Dem/Rep	51D / 49R					2020 Troy Gain Dem/Rep	80D / 20R	